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ing plants the organ that creeps may be either the stem, the stolons, or the roots. Finally, the fifth subclass contains species with the shoots elongated, which are able to persist for many years, for instance, the herbaceous *Arabis alpina*, also *Armeria*, *Androsace*, *Eritrichium*, etc.; and among the woody forms, *Bambuseae*, *Coniferae*, the dicotyledonous trees, etc.

An interesting chapter is devoted to the leaves and leafy shoots. The author recognizes three factors as being the direct cause of the shape of the leaf: (1) its function as an organ of assimilation; (2) the medium in which it lives (air or water); (3) the particular structure (outline especially) which belongs to the species, thus constituting a specific and very marked character developed through relationship. But the author makes no mention of the position of the leaf upon the shoot as having any bearing upon its form, although this seems an important factor when one remembers the great variation in leaves from seedling to mature plant, so profusely illustrated in North American plants especially.

The arrangement of plants according to their biologic character is a most difficult task, if really possible. To arrange plants in accordance with their vitality, as for example annuals, biennials, and perennials, gives no satisfaction; yet the question of age is of no small importance in classification. The characterization of biologic types, when comprising the structure of the shoot, leads us into perplexing difficulties, on account of the enormous number of intergrading forms that exist, of rhizomes for instance. It appears to the reviewer that the autonomic land plants have been classified less successfully than the others. However, we know of no system published, so far, where the classification of this particular group of plants has been outlined in any way clearer than the one suggested by WARMING. Much would be gained if the ecologists would follow his example and study the plants in the field, and not merely in the laboratory. It seems very strange that modern botanists pay so little attention to the study of organography, which actually is one of the bases of ecology; and plant-geography is indeed of no less importance. WARMING'S paper contains in itself an excellent guide to future workers in this line, and we hope that translations may follow soon, so as to make the paper more accessible to foreigners.—THEO. HOLM.

A text-book of botany and pharmacognosy

A second edition of KRAEMER'S *Text-book* has appeared,² designed primarily for students of pharmacy, for pharmacists, and for food and drug analysts. Perhaps it is not the province of a botanist to review it, but it certainly is an interesting illustration of the kind of botany required of students of pharmacy; besides, some of the introductory chapters deal with botany in the ordinary sense. The first impression is that of a mass of details, without any thread of continuity, which makes a book of reference rather than a textbook, a book to consult rather than to read.

² KRAEMER, HENRY, A text-book of botany and pharmacognosy. pp. vi+840. *pls. 321 (figs. 1500).* Philadelphia and London: J. B. Lippincott Co. 1907.

The first chapter describes the "principal groups of plants," in which types are selected to represent the groups. The descriptions are systematic in form, encyclopedic in content, and entirely unrelated. Just what the student is expected to do with this part is not clear. There follow chapters on the "outer morphology of angiosperms" and "the inner morphology of the higher plants." This old breaking-up of a subject that cannot be broken is artificial in the highest degree. The confusion is increased by referring to the first topic as "the anatomy or outer structure of the angiosperms;" and to the second as "the inner structure or histology of the higher plants." This may be what students of pharmacy need, but it is not modern botany.

The remaining chapters deal with the professional details of pharmacy; although under Part I, which bears the title "Botany," there appear chapters on the "classification of angiosperms yielding vegetable drugs," and "cultivation of medicinal plants." Part II is entitled "Pharmacognosy" and contains chapters on crude drugs, powdered drugs, and foods. Part III is devoted to "reagents and microscopical technique."—J. M. C.

NOTES FOR STUDENTS

Synapsis.—GRÉGOIRE has published³ an interpretation of synapsis opposing HERTWIG's new theory and confirming his own earlier view. He states that the nucleus in synapsis passes through three principal states (*leptotènes*, *pachytènes*, *strepstènes*), and that synapsis represents a primary state of heterotypic prophase. He says that cytologists diverge into two schools: one believing that the pre-reduction of chromosomes occurs in the zygonema stage, the bivalent chromosomes in the strepsinema stage representing the paired true chromosomes in heterotypic mitosis; the other believing that the pre-reduction is effected by a folding back, in the strepsinema stage, of a chromosome which is believed to be composed of two somatic chromosomes attached end to end. However, they all agree in considering synapsis as a stage in the development of the heterotypic chromosomes.

Taking WOLTERECK's conception, R. HERTWIG proposed an entirely new interpretation of synapsis, deduced from his theory of nucleoplasmic relation. The gist of the theory is this: increase of protoplasm cannot continue without an intervention of nuclear division which may or may not be followed by cell division. After cell division, the increase of protoplasm and of nucleus cannot proceed equally, the former generally being ahead of the latter; so the nucleoplasmic quotient (K/P) tends to diminish. HERTWIG designates the state of equilibrium as "nucleoplasmic tension." This tension causes a sudden and considerable increase of the nucleus, which results in the increase of chromatin. The increase of protoplasm and consequent increase of chromatin can be brought back to equilibrium only by nuclear division. Applying the theory to the nuclear division in tetradogeneses (sporogenesis, spermatogenesis, and ovogenesis), he

³ GRÉGOIRE, VICTOR, Les phénomènes de l'étape synaptique représentent-ils une caryocinèse avortée? *La Cellule* 25:87-99. 1908.